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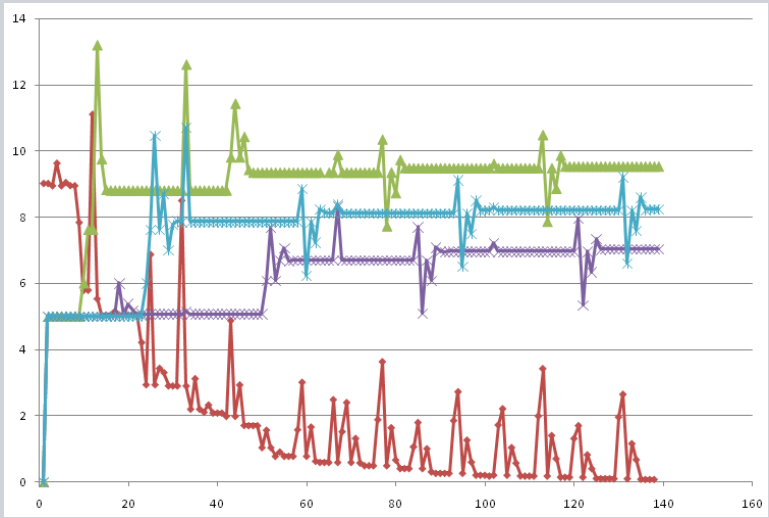
Optimization and Design Studies



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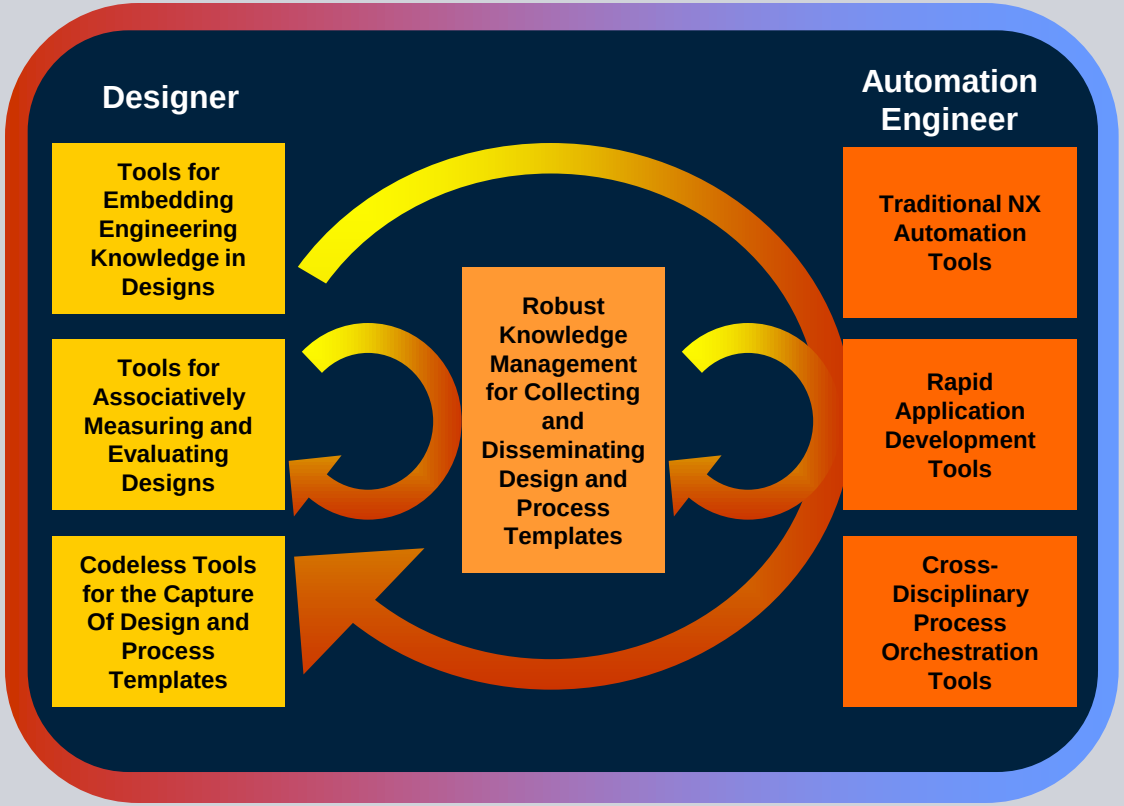
Wednesday, June 4th, 2008
UGS Connection Conference

Knowledge Automation Vision



Directions

NX will have robust interactive knowledge tools through which product knowledge can be quickly captured and easily reused to accelerate product development.

NX will have a robust set of numerical tools for design exploration and engineering optimization.

NX will continue to have an industry-leading set of programmatic tools for knowledge automation.

Optimization (1/3)

Block-based UI Interaction

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Capability in NX 6

New “de-wizardized” Block-based UI.

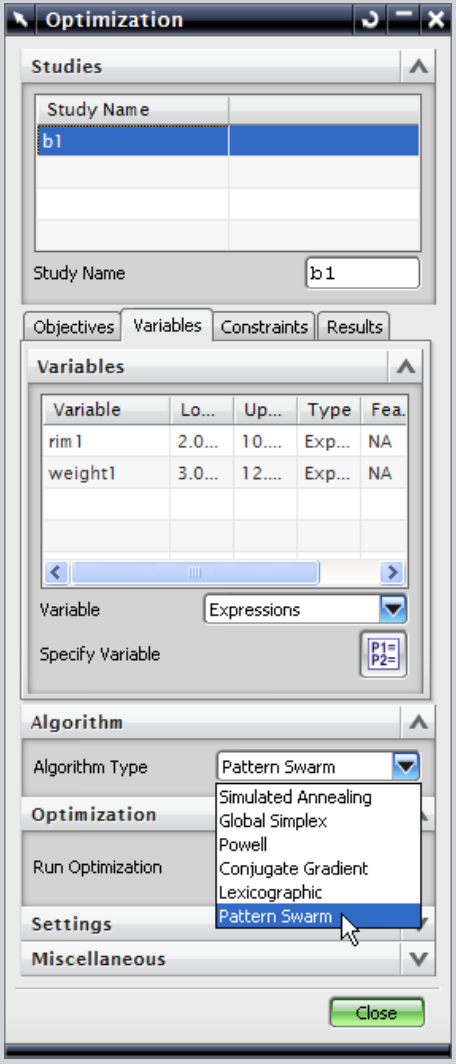
Several new local and global algorithms have been implemented.

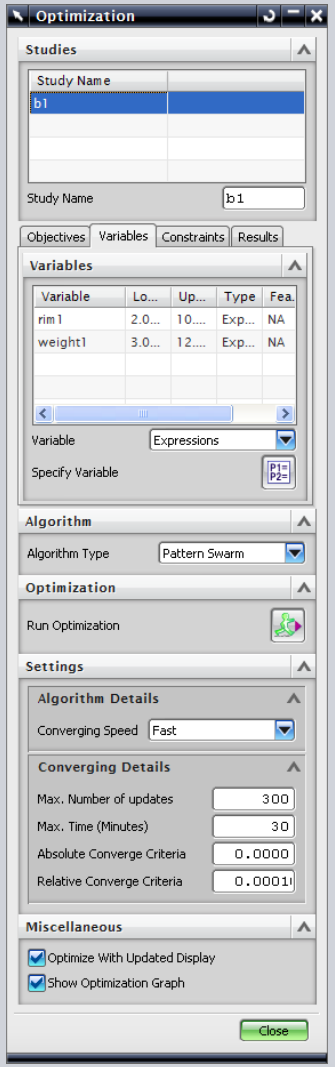
Why is this important to you?

The wizard interaction, while simple, was excessively time consuming.

The new algorithms converge more reliably and are much more globally effective.

Available programmatically via KF as well.





Optimization (2/3)

New <u>LOCAL</u> Algorithms in NX 6

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<u>Local Algorithms:</u>

Powell – Minimizes each design variable in sequence, rotating through the list of all design variables until the minimum is reached. This method does not use derivatives, and is quite intuitive to watch.

Conjugate Gradient – If we can calculate derivatives easily then this method converges very quickly. However, in most CAD cases the objective will not have a mathematical form and we will use a difference method to approximate derivatives. Powell will usually be recommended over this one.

Optimization (3/3)

New GLOBAL Algorithms in NX 6

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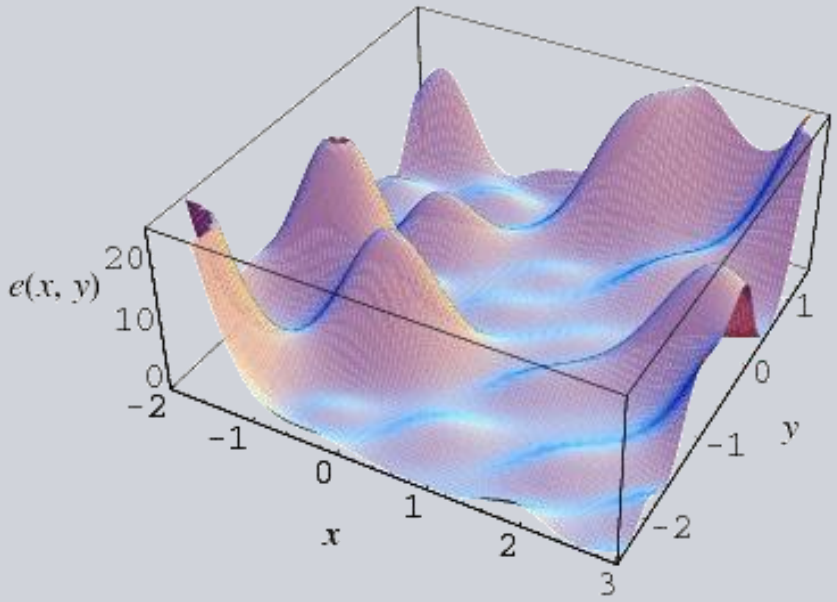
Global Algorithms:

Global Simplex – Uses a random sampling to find likely areas where the global minimum may exist, and then employs a geometric (simplex) method to achieve the minimum. This method does not rely on derivative information and is rather intuitive.

Simulated Annealing – Uses a "slow cooling" method to reach a least energy state (much like crystallization, actually.) This method is time consuming but is known to provide global solution in a majority of cases.

Lexicographic – Originally designed to be used with multiple objectives. Objectives are ranked in order of importance, and the optimum solution is found by using an annealing method to minimize the objective functions starting with the most important and proceeding in order of importance. (Note: We have not yet exposed multiple objectives.)

Pattern Swarm – Uses the newest (2006) algorithm for global optimization which does not use derivatives. In most optimization methods we start out with a single point in the design space and choose the direction to take the next step to optimization. This method starts out selecting a set of points, and then tries to move each into the optimal position. The process is time consuming but does an impressive job of converging to the global solution very reliably.



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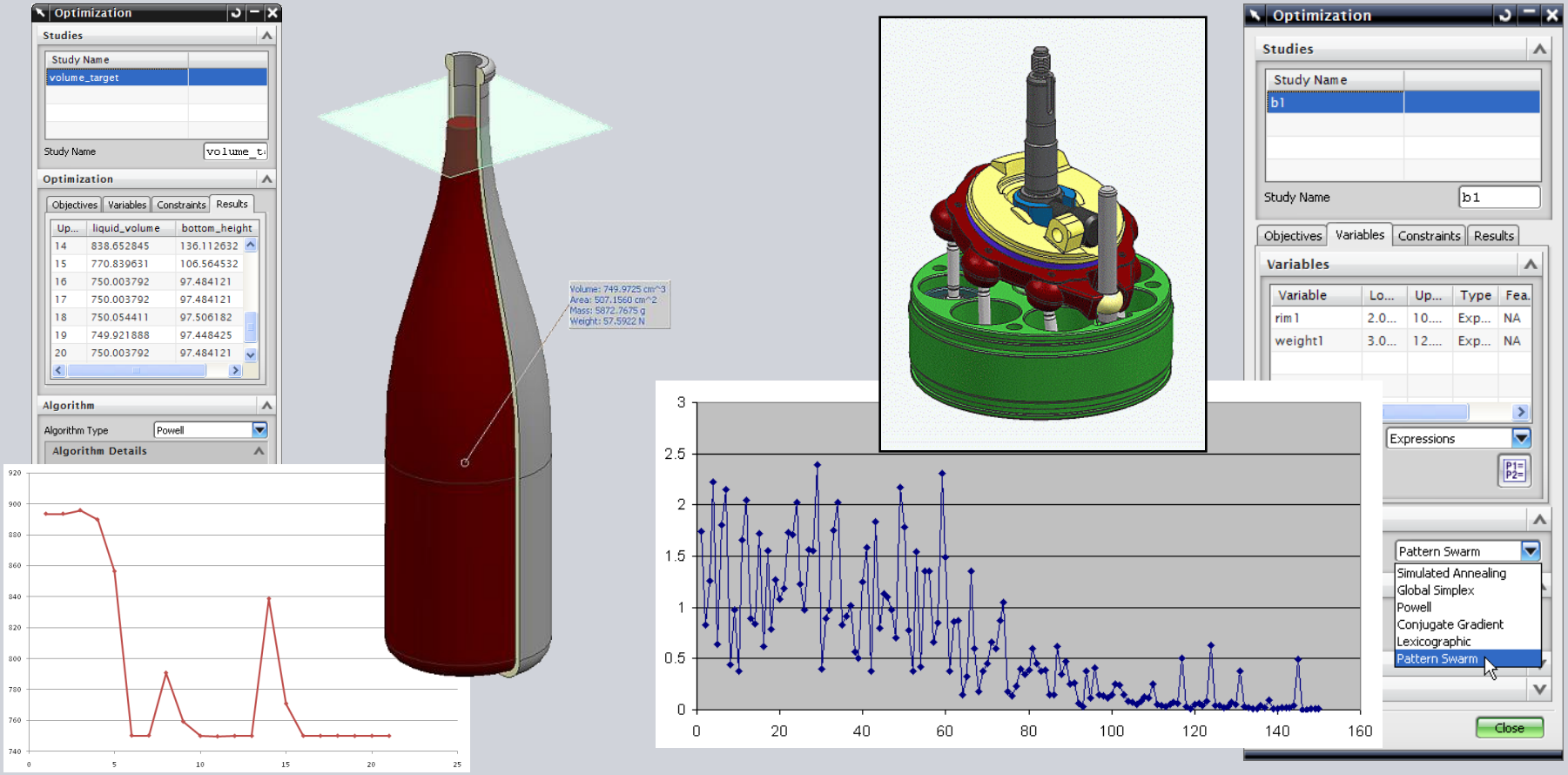
Optimization Demonstrations



Design Studies / Sensitivity Studies

Project Detail

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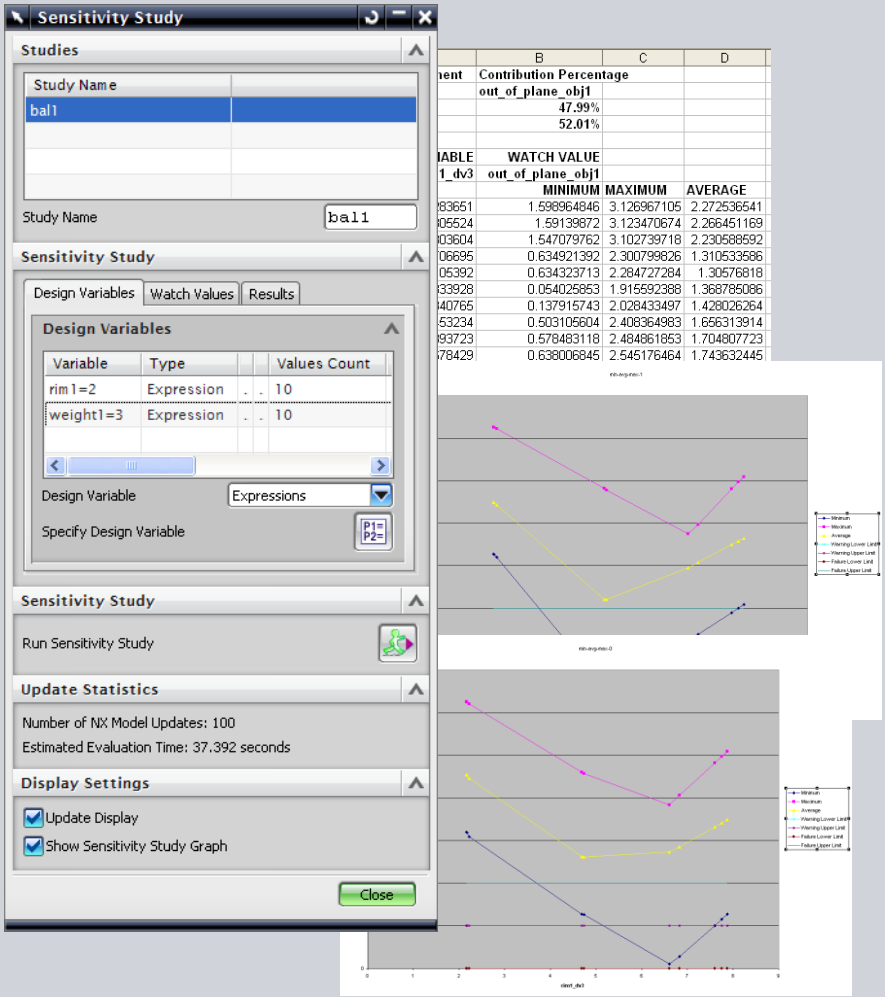
Capability in NX 6

Users can vary one or more model parameters over specified ranges to observe the effect on the model's performance and to evaluate design trade-offs.

Why is this important to you?

Gives users the ability to generate a range of models in batch mode and understand more complex parameter interactions.

Very useful for evaluating robustness of templates or other custom objects over a design space.



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Design Studies Demonstrations

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Thank you!